EXHIBIT 5

INTERNATIONAL STANDARD

ISO/IEC 10589

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Information technology — Telecommunications and information exchange between systems — Intermediate System to Intermediate System intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode network service (ISO 8473)

Technologies de l'information — Communication de données et échange d'informations entre systèmes — Protocole intra-domaine de routage d'un système intermédiaire à un système intermédiaire à utiliser conjointement avec le protocole fournissant le service de réseau en mode sans connexion (ISO 8473)

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3.6.1 area: A routeing subdomain which maintains detailed routeing information about its own internal composition, and also maintains routeing information which allows it to reach other routeing subdomains. It corresponds to the Level 1 subdomain.

3.6.2 neighbour: An adjacent system reachable by traversal of a single subnetwork by a PDU.

3.6.3 adjacency: A portion of the local routeing information which pertains to the reachability of a single neighbour ES or IS over a single circuit.

Adjacencies are used as input to the Decision Process for forming paths through the routeing domain.

A separate adjacency is created for each neighbour on a circuit, and for each level of routeing (i.e. level 1 and level 2) on a broadcast circuit.

3.6.4 circuit: A subset of the local routeing information base pertinent to a single local SNPA. The system management view of a circuit is presented in a linkage managed object.

3.6.5 link: The communication path between two neighbours.

A link is "up" when communication is possible between the two SNPAs.

3.6.6 designated IS: The Intermediate system on a LAN, which is designated to perform additional duties. In particular it generates Link State PDUs on behalf of the LAN, treating the LAN as a pseudonode.

3.6.7 pseudonode: Where a broadcast subnetwork has *n* connected Intermediate systems, the broadcast subnetwork itself is considered to be a pseudonode.

The pseudonode has links to each of the *n* Intermediate and End systems. Each of the ISs has a single link to the pseudonode (rather than *n-1* links to each of the other Intermediate systems). Link State PDUs are generated on behalf of the pseudonode by the Designated IS. This is depicted below in figure 1.

3.6.8 broadcast subnetwork: A subnetwork which supports an arbitrary number of End systems and Intermediate systems and additionally is capable of transmitting a single SNPDU to a subset of these systems in response to a single SN_UNITDATA request.

3.6.9 general topology subnetwork: A subnetwork which supports an arbitrary number of End systems and Intermediate systems, but does not support a convenient multi-destination connectionless transmission facility, as does a broadcast subnetwork.

3.6.10 routeing subdomain: a set of Intermediate systems and End systems located within the same Routeing domain.

3.6.11 level 2 subdomain: the set of all Level 2 Intermediate systems in a Routeing domain.

3.6.12 jitter: a small random variation introduced into the value of a timer to prevent multiple timer expirations in different systems from becoming synchronised.
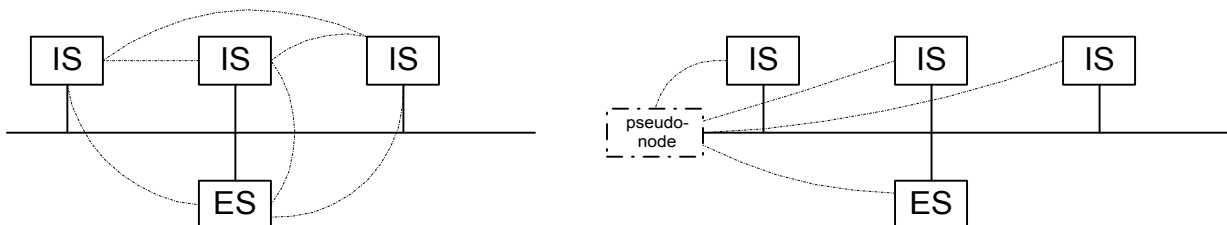

Figure 1 - Use of a pseudonode to collapse a LAN Topology

4   Symbols and abbreviations

4.1   Data units

PDU	Protocol Data Unit
SNSDU	Subnetwork Service Data Unit
NSDU	Network Service Data Unit
NPDU	Network Protocol Data Unit
SNPDU	Subnetwork Protocol Data Unit

4.2   Protocol data units

ESH PDU	ISO 9542 End System Hello Protocol Data Unit
ISH PDU	ISO 9542 Intermediate System Hello Protocol Data Unit
RD PDU	ISO 9542 Redirect Protocol Data Unit
IIH PDU	Intermediate System to Intermediate System Protocol Data Unit
LSP	Link State Protocol Data Unit
SNP	Sequence Numbers Protocol Data Unit
CSNP	Complete Sequence Numbers Protocol Data Unit
PSNP	Partial Sequence Numbers Protocol Data Unit

4.3   Addresses

AFI	Authority and Format Indicator
DSP	Domain Specific Part
IDI	Initial Domain Identifier
IDP	Initial Domain Part
NET	Network Entity Title
NPAI	Network Protocol Addressing Information
NSAP	Network Service Access Point
SNPA	Subnetwork Point of Attachment

4.4   Miscellaneous

DA	Dynamically Assigned
DED	Dynamically Established Data Link
DTE	Data Terminal Equipment
ES	End System
IS	Intermediate System
HDLC	High Level Data Link Control
ISDN	Integrated Services Digital Network
FDDI	Fiber Distributed Data Interface
L1	Level 1
L2	Level 2
LAN	Local Area Network
MAC	Media Access Control
MAN	Metropolitan Area Network
MCS	Management conformance summary
MICS	Management information conformance statement
MOCS	Managed object conformance statement
MRCS	Managed relationship conformance statement
NLPID	Network Layer Protocol Identifier
PSTN	Public Switched Telephone Network
OSIE	Open Systems Interconnection Environment

6.8.2   Update process

This process constructs, receives and propagates Link State PDUs. Each Link State PDU contains information about the identity and routeing metric values of the adjacencies of the IS that originated the Link State PDU.

The Update Process receives Link State and Sequence Numbers PDUs from the Receive Process — **4** in figure 3. It places new routeing information in the routeing information base — **6** and propagates routeing information to other Intermediate systems – **7** and **8**.

General characteristics of the Update Process are:

- Link State PDUs are generated as a result of topological changes, and also periodically. They may also be generated indirectly as a result of System Management actions (such as changing one of the routeing metrics for a circuit).

- Level 1 Link State PDUs are propagated to all Intermediate systems within an area, but are not propagated out of an area.

- Level 2 Link State PDUs are propagated to all Level 2 Intermediate systems in the domain.

- Link State PDUs are not propagated outside of a domain.

- The update process, through a set of System Management parameters, enforces an upper bound on the amount of routeing traffic overhead it generates.

6.8.3   Forwarding process

This process supplies and manages the buffers necessary to support NPDU relaying to all destinations.

It receives, via the Receive Process, ISO 8473 PDUs to be forwarded – 5 in figure 3.

It performs a lookup in the appropriate[1] Forwarding Database – 11 – to determine the possible output adjacencies to use for forwarding to a given destination, chooses one adjacency – 12 —, generates error indications to ISO 8473 – 14 , and signals ISO 9542 to issue Redirect PDUs – 13 .

6.8.4   Receive process

The Receive Process obtains its inputs from the following sources

- received PDUs with the NLPID of Intra-Domain routeing – 2 in figure 3,

- routeing information derived by the ES–IS protocol from the receipt of ISO 9542 PDUs – 1 ; and

- ISO 8473 data PDUs handed to the routeing function by the ISO 8473 protocol machine – 3.

- It then performs the appropriate actions, which may involve passing the PDU to some other function (e.g. to the Forwarding Process for forwarding – 5).

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[1]   The appropriate forwarding database is selected by choosing a routeing metric based on fields in the QoS Maintenance option field of ISO 8473.

Table 9 – Architectural constants for use with ISO 8802 subnetworks

Multi-destination Address	Binding	Description
AllL1ISs	01-80-C2-00-00-14	The multi-destination address "All L1 Intermediate Systems"
AllL2ISs	01-80-C2-00-00-15	The multi-destination address "All L2 Intermediate Systems"
AllIntermediateSystems	09-00-2B-00-00-05	The multi-destination address "All Intermediate Systems" used by ISO 9542
AllEndSystems	09-00-2B-00-00-04	The multi-destination address "All End Systems" used by ISO 9542

9   Structure and encoding of PDUs

This clause describes the PDU formats of the Intra-Domain IS–IS routeing protocol.

9.1   General encoding rules

Octets in a PDU are numbered starting from 1, in increasing order. Bits in a octet are numbered from 1 to 8, where bit 1 is the least significant bit and is pictured on the right. When consecutive octets are used to represent a number, the lower octet number has the most significant value.

Fields marked Reserved (or simply R) are transmitted as zero, and ignored on receipt, unless otherwise noted.

Values are given in decimal. All numeric fields are unsigned integers, unless otherwise noted.

9.2   Encoding of network layer addresses

Network Layer addresses (NSAP addresses, NETs, area addresses and Address Prefixes) are encoded in PDUs according to the preferred binary encoding specified in ISO

8348; the entire address, taken as a whole is represented explicitly as a string of binary octets. This string is conveyed in its entirety in the address fields of the PDUs. The rules governing the generation of the preferred binary encoding are described in ISO 8348. The address so generated is encoded with the most significant octet (i.e. the AFI) of the address being the first octet transmitted, and the more significant semi-octet of each pair of semi-octets in the address is encoded in the more significant semi-octet of each octet (i.e. in the high order 4 bits). Thus the address /371234 is encoded as shown in figure 7.

		No. of Octets
3	7	1
1	2	1
3	4	1

Figure 7 - Address encoding example

9.3   Encoding of SNPA addresses

SNPA addresses (e.g. LAN Address) shall be encoded according to the rules specified for the particular type of subnetwork being used.

In the case of an ISO/IEC 8802 (except for ISO/IEC 8802-6 DQDB) or ISO/IEC 9314 subnetwork, the SNPA address is the 48-bit MAC address encoded as a sequence of six octets according to the "hexadecimal representation" of MAC addresses specified in ISO/IEC 10039. The SNPA address of an ISO/IEC 8802-6 DQDB shall be encoded as a sequence of eight octets containing 4-bit address type subfield, variable length padding subfield and variable length MAC service access point address subfield according to the "hexadecimal representation".

NOTE 53   In this encoding the first bit of the binary representation of the SNPA address is the least significant bit of the first octet in the encoded sequence.

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9.4   PDU types

The types of PDUs are:

-   Level 1 LAN IS to IS Hello PDU

-   Level 2 LAN IS to IS Hello PDU

-   Point-to-Point IS to IS Hello PDU

-   Level 1 Link State PDU

-   Level 2 Link State PDU

-   Level 1 Complete Sequence Numbers PDU

-   Level 2 Complete Sequence Numbers PDU

-   Level 1 Partial Sequence Numbers PDU

-   Level 2 Partial Sequence Numbers PDU

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These are described in the following subclauses.

9.5   Level 1 LAN IS to IS hello PDU

This PDU is multicast by Intermediate systems on broadcast circuits to the multi-destination address AllL1ISs. The purpose of this PDU is for Intermediate systems on broadcast circuits to discover the identity of other Level 1 Intermediate systems on that circuit. Trailing Pad option fields are inserted to make PDU Length equal to at least *maxsize - 1* where *maxsize* is the maximum of

-   dataLinkBlocksize

-   originatingL1LSPBufferSize

(see 8.4.2).

				No. of Octets
Intradomain Routeing Protocol Discriminator				1
Length Indicator				1
Version/Protocol ID Extension				1
ID Length				1
R	R	R	PDU Type	1
Version				1
Reserved				1
Maximum Area Addresses				1
Reserved/Circuit Type				1
Source ID				ID Length
Holding Time				2
PDU Length				2
R	Priority			1
LAN ID				ID Length + 1
VARIABLE LENGTH FIELDS				VARIABLE

-   Intradomain Routeing Protocol Discriminator — architectural constant (see table 2)

-   Length Indicator – Length of the fixed header in octets

-   Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  - An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  - The value zero, which indicates a 6 octet ID field length

  - The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type (bits 1 through 5) – 15.

NOTE 54   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt

- Version – 1

- Reserved — transmitted as zero, ignored on receipt
- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximum-AreaAddresses. This field shall take on of the following values:

  - An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  - The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

- Reserved/Circuit Type – Most significant 6 bits reserved (Transmitted as zero, ignored on receipt). Low order bits (bits 1 and 2) indicate:

  - 0 – reserved value (if specified the entire PDU shall be ignored)

  - 1 — Level 1 only

  - 2 — Level 2 only (sender is Level 2 Intermediate system with manualL2OnlyMode set "True" for this circuit, and will use this link only for Level 2 traffic)

  - 3 – both Level 1 and Level 2 (sender is Level 2 Intermediate system, and will use this link both for Level 1 and Level 2 traffic)

NOTE 55   In a LAN Level 1 IIH PDU the Circuit Type shall be either 1 or 3.

- Source ID – the system ID of transmitting Intermediate system

- Holding Time – Holding Timer to be used for this Intermediate system

- PDU Length – Entire length of this PDU, in octets, including header

- Reserved/Priority – Bit 8 reserved (Transmitted as zero, ignored on receipt). Bits 1 through 7 – priority for being LAN Level 1 Designated Intermediate System. Higher number has higher priority for being LAN Level 1 Designated Intermediate System. Unsigned integer.

- LAN ID – a field composed the system ID (1–8 octets) of the LAN Level 1 Designated Intermediate System, plus a low order octet assigned by LAN Level 1 Designated Intermediate System. Copied from LAN Level 1 Designated Intermediate System's IIH PDU.

- VARIABLE LENGTH FIELDS – fields of the form:

	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

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Any codes in a received PDU that are not recognised shall be ignored.

Currently defined codes are:

- Area Addresses – the set of manualAreaAddresses of this Intermediate System.

  x CODE – 1
  x LENGTH – total length of the value field.
  x VALUE –

	No. of Octets
Address Length	1
Area Address	Address Length
Address Length	1
Area Address	Address Length

- Address Length – Length of Area Address in octets.

- Area Address – Area address.

- Intermediate System Neighbours – The set of Intermediate systems on this LAN to which adjacencies of neighborSystemType "L1 Intermediate System" exist in state "Up" or "Initialising" (i.e. those from which Level 1 IIH PDUs have been heard). This is permitted to appear more than once.

Two types of codes are defined:

  a)   Intermediate System Neighbors with 6 octet MAC address
  x CODE – 6
  x LENGTH – total length of the value field in octets
  x VALUE –

	No. of Octets
LAN Address	6
LAN Address	6

- LAN Address (6 octet length) – 6 octet MAC Address of Intermediate System neighbour.

  b)   Intermediate System Neighbors with variable length SNPA address

  x CODE – 7
  x LENGTH – total length of the value field in octets
  x VALUE-

	No. of Octets
Lan Address Length	1
LAN Address (variable length)	LAN Address Length
LAN Address (variable length)	LAN Address Length

- LAN Address Length – length of SNPA address of Intermediate System neighbors.

- LAN Address (variable length) – variable length SNPA address of Intermediate System neighbors

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This variable length field shall not be used for the Intermediate System Neighbor of which SNPA address length is 6 octets.

- Padding – This option may occur more than once. It is used to pad the PDU to at least *maxsize* - 1.

  x CODE – 8.
  x LENGTH – total length of the value field (may be zero).
  x VALUE – LENGTH octets of arbitrary value.

  - Authentication Information — information for performing authentication of the originator of the PDU.

  x CODE — 10.
  x LENGTH — variable from 1–254 octets
  x VALUE —

No. of Octets

Authentication Type	1
Authentication Value	VARIABLE

- Authentication Type — a one octet identifier for the type of authentication to be carried out. The following values are defined:

  0 — RESERVED
  1 — Cleartext Password
  2–254 — RESERVED
  255 — Routeing Domain private authentication method

- Authentication Value — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

9.6   Level 2 LAN IS to IS hello PDU

This PDU is multicast by Intermediate systems on broadcast circuits to the multi-destination address AllL2ISs. The purpose of this PDU is for Intermediate systems on broadcast circuits to discover the identity of other Level 2 Intermediate systems on that circuit. Trailing Pad options are inserted to make PDU Length equal to at least *maxsize - 1* where

- dataLinkBlocksize

- originatingL2LSPBufferSize

(see 8.4.2).

No. of Octets

Intradomain Routeing Protocol Discriminator				1
Length Indicator				1
Version/Protocol ID Extension				1
ID Length				1
R	R	R	PDU Type	1
Version				1
Reserved				1
Maximum Area Addresses				1
Reserved/Circuit Type				1
Source ID				ID Length
Holding Time				2
PDU Length				2
R	Priority			1
LAN ID				ID Length + 1
VARIABLE LENGTH FIELDS				VARIABLE

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- Intradomain Routeing Protocol Discriminator – architectural constant (see table 2)

- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  • An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  • The value zero, which indicates a 6 octet ID field length

  • The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type (bits 1 through 5) – 16.

NOTE 56   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt.

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

  • An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  • The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

NOTE 57 This field is ignored on receipt.

- Reserved/Circuit Type – Most significant 6 bits reserved (Transmitted as zero, ignored on receipt). Low order bits (bits 1 and 2) indicate:

  • 0 – reserved value (if specified the entire PDU shall be ignored)

  • 1 – Level 1 only

  • 2 – Level 2 only (sender is Level 2 Intermediate System with manualL2OnlyMode set "True" for this circuit, and will use this link only for Level 2 traffic)

  • 3 – both Level 1 and Level 2 (sender is Level 2 Intermediate System, and will use this link both for Level 1 and Level 2 traffic)

NOTE 58   In a LAN Level 2 IIH PDU the Circuit Type shall be either 2 or 3

- Source ID – the system ID of transmitting Intermediate System

- Holding Time – Holding Timer to be used for this Intermediate System

- PDU Length – Entire length of this PDU, in octets, including header

- Reserved/Priority – Bit 8 reserved (Transmitted as zero, ignored on receipt). Bits 1 through 7 – priority for being LAN Level 2 Designated Intermediate System. Higher number has higher priority for being LAN Level 2 Designated Intermediate System. Unsigned integer.

- LAN ID – a field composed the system ID (1–8 octets) of the LAN Level 2 Designated Intermediate System, plus a low order octet assigned by LAN Level 2 Designated Intermediate System. Copied from LAN Level 2 Designated Intermediate System's IIH PDU.

- VARIABLE LENGTH FIELDS – fields of the form:

	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received PDU that are not recognised shall be ignored.

Currently defined codes are:

- **Area Addresses** – the set of manualAreaAddresses of this Intermediate system.

  x CODE – 1
  x LENGTH – total length of the value field.
  x VALUE –

	No. of Octets
Address Length	1
Area Address	Address Length
Address Length	1
Area Address	Address Length

· Address Length – Length of area address in octets.

· Area Address – Area address.

NOTE 59   This option field may be omitted, and is ignored on receipt if present.

- **Intermediate System Neighbours** – The set of Intermediate systems on this LAN to which adjacencies of neighborSystemType "L2 Intermediate System" exist in state "Up" or "Initialising" (i.e. those from which Level 2 IIH PDUs have been heard). This is permitted to appear more than once.

Two types of codes are defined:

a) Intermediate System Neighbors with 6 octet MAC address

x CODE – 6
x LENGTH – total length of the value field in octets
x VALUE –

	No. of Octets
LAN Address	6
LAN Address	6

- LAN Address (6 octet length) – 6 octet MAC Address of Intermediate System neighbour.

b) Intermediate System Neighbors with variable length SNPA address

x CODE – 7
x LENGTH – total length of the value field in octets
x VALUE-

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	No. of Octets
Lan Address Length	1
LAN Address (variable length)	LAN Address Length
LAN Address (variable length)	LAN Address Length

- LAN Address Length – length of SNPA address of Intermediate System neighbors.

- LAN Address (variable length) – variable length SNPA address of Intermediate System neighbors

This variable length field shall not be used for the Intermediate System Neighbor of which SNPA address length is 6 octets.

- Padding – This option may occur more than once. It is used to pad the PDU to at least *maxsize* - 1.

   x CODE – 8.
   x LENGTH – total length of the value field (may be zero).
   x VALUE – LENGTH octets of arbitrary value.

- Authentication Information — information for performing authentication of the originator of the PDU.

   x CODE — 10.
   x LENGTH — variable from 1–254 octets
   x VALUE —

	No. of Octets
Authentication Type	1
Authentication Value	VARIABLE

· Authentication Type — a one octet identifier for the type of authentication to be carried out. The following values are defined:

0 — RESERVED
1 — Cleartext Password
2–254 — RESERVED
255 — Routeing Domain private authentication method

· Authentication Value — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

9.7   Point-to-point IS to IS hello PDU

This PDU is transmitted by Intermediate systems on nonbroadcast circuits, after receiving an ISH PDU from the neighbour system. Its purpose is to determine whether the neighbour is a Level 1 or a Level 2 Intermediate System. Trailing pad options are inserted to make PDU Length equal to at least *maxsize* - *1* where *maxsize* is the maximum of

- dataLinkBlocksize

- originatingL1LSPBufferSize

- originatingL2LSPBufferSize

(see 8.2.3).

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				No. of Octets
Intradomain Routeing Protocol Discriminator				1
Length Indicator				1
Version/Protocol ID Extension				1
ID Length				1
R	R	R	PDU Type	1
Version				1
Reserved				1
Maximum Area Addresses				1
Reserved/Circuit Type				1
Source ID				ID Length
Holding Time				2
PDU Length				2
Local Circuit ID				1
VARIABLE LENGTH FIELDS				VARIABLE

- Intradomain Routeing Protocol Discriminator — architectural constant (see table 2)

- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  • An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  • The value zero, which indicates a 6 octet ID field length

  • The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type — (bits 1 through 5) – 17.

NOTE 60   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt.

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

  • An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  • The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

- Reserved/Circuit Type – Most significant 6 bits reserved (Transmitted as zero, ignored on receipt). Low order bits (bits 1 and 2) indicate:

  • 0 – reserved value (if specified the entire PDU shall be ignored)

  • 1 – Level 1 only

  • 2 – Level 2 only (sender is Level 2 Intermediate system with manualL2OnlyMode set "True" for this circuit, and will use this link only for Level 2 traffic)

  • 3 – both Level 1 and Level 2 (sender is Level 2 Intermediate system and will use this link both for Level 1 and Level 2 traffic)

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- Source ID – the system ID of transmitting Intermediate system

- Holding Time – Holding Timer to be used for this Intermediate system

- PDU Length – Entire length of this PDU, in octets, including header

- Local Circuit ID – 1 octet unique ID assigned to this circuit when it is created by this Intermediate system.

- VARIABLE LENGTH FIELDS – fields of the form:

	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received PDU that are not recognised shall be ignored.

Currently defined codes are:

- Area Addresses – the set of manualAreaAddresses of this Intermediate system

  x CODE – 1
  x LENGTH – total length of the value field.
  x VALUE –

	No. of Octets
Address Length	1
Area Address	Address Length
Address Length	1
Area Address	Address Length

· Address Length – Length of area address in octets.

· Area Address – Area address.

- Padding – This option may occur more than once. It is used to pad the PDU to at least *maxsize* - 1.

  x CODE – 8.
  x LENGTH – total length of the value field (may be zero).
  x VALUE – LENGTH octets of arbitrary value.

- Authentication Information — information for performing authentication of the originator of the PDU.

  x CODE — 10.
  x LENGTH — variable from 1–254 octets
  x VALUE —

	No. of Octets
Authentication Type	1
Authentication Value	VARIABLE

· Authentication Type — a one octet identifier for the type of authentication to be carried out. The following values are defined:

0 — RESERVED

1 — Cleartext Password

2–254 — RESERVED

255 — Routeing Domain private authentication method

· **Authentication Value** — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

9.8   Level 1 link state PDU

Level 1 Link State PDUs are generated by Level 1 and Level 2 Intermediate systems, and propagated throughout an area. The contents of the Level 1 Link State PDU indicates the state of the adjacencies to neighbour Intermediate Systems, or pseudonodes, and End systems of the Intermediate system that originally generated the PDU.

				No. of Octets
Intradomain Routeing Protocol Discriminator				1
Length Indicator				1
Version/Protocol ID Extension				1
ID Length				1
R	R	R	PDU Type	1
Version				1
Reserved				1
Maximum Area Addresses				1
PDU Length				2
Remaining Lifetime				2
LSP ID				ID Length + 2
Sequence Number				4
Checksum				2
P	ATT	LSPDBOL	IS Type	1
VARIABLE LENGTH FIELDS				VARIABLE

- **Intradomain Routeing Protocol Discriminator** – architectural constant (see table 2)

- **Length Indicator** – Length if fixed header in octets

- **Version/Protocol ID Extension** — 1

- **ID Length** — Length of the **ID** field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  - An integer between 1 and 8, inclusive, indicating an **ID** field of the corresponding length

  - The value zero, which indicates a 6 octet **ID** field length

  - The value 255, which means a null **ID** field (i.e. zero length)

All other values are illegal and shall not be used.

- **PDU Type** (bits 1 through 5) – 18.

- **Version** – 1

- **Reserved** — transmitted as zero, ignored on receipt

- **Maximum Area Addresses** — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter **maximumArea-Addresses**. This field shall take on of the following values:

  - An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

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- • The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

- PDU Length – Entire Length of this PDU, in octets, including header.

- Remaining Lifetime – Number of seconds before LSP considered expired

- LSP ID – the system ID of the source of the Link State PDU. It is structured as follows:

	No. of Octets
Source ID	ID Length
Pseudonode ID	1
LSP Number	1

- Sequence Number – sequence number of LSP

- Checksum – Checksum of contents of LSP from Source ID to end. Checksum is computed as described in 7.3.11.

- P/ATT/LSPDBOL/IS Type

- • P – Bit 8, indicates when set that the issuing Intermediate System supports the Partition Repair optional function.

- • ATT - Bits 7-4 indicate, when set, that the issuing Intermediate System is 'attached' to other areas using:

x Bit 4 - the Default Metric

x Bit 5 - the Delay Metric

x Bit 6 - the Expense Metric

x Bit 7 - the Error Metric.

- • LSPDBOL – Bit 3 – A value of 0 indicates no LSP Database Overload, and a value of 1 indicates that the LSP Database is Overloaded. An LSP with this bit set will not be used by any decision process to calculate routes to another IS through the originating system.

- • IS Type – Bits 1 and 2 indicate the type of Intermediate System – One of the following values:

x 0 – Unused value

x 1 – (i.e. bit 1 set) Level 1 Intermediate system

x 2 – Unused value

x 3 – (i.e. bits 1 and 2 set) Level 2 Intermediate system.

- VARIABLE LENGTH FIELDS – fields of the form:

	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received LSP that are not recognised are ignored and passed through unchanged.

Currently defined codes are:

- • Area Addresses – the set of manualAreaAddresses of this Intermediate system. For non-pseudonode LSPs this option shall always be present in the LSP with LSP number zero, and shall never be present in an LSP with non-zero LSP

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number. It shall appear before any Intermediate System Neighbours or End System Neighbours options. This option shall never be present in pseudonode LSPs.

    x CODE – 1
    x LENGTH – total length of the value field.
    x VALUE –

	No. of Octets
Address Length	1
Area Address	Address Length
Address Length	1
Area Address	Address Length

· Address Length – Length of area address in octets.

· Area Address – Area address.

- originatingLSPBufferSize – the local value for originatingL1LSPBufferSize

This may appear only once in an LSP with any LSP number. It shall appear before any Intermediate System Neighbours or End System Neighbours options.

NOTE 61 It is recommended that this option be used only in the LSP with LSP number zero. However, the presence or absence of this option in any LSP shall not be required.

    x CODE – 14
    x LENGTH – 2
    x VALUE – 512-1492

- Intermediate System Neighbours – Intermediate system and pseudonode neighbours.

This is permitted to appear more than once, and in an LSP with any LSP number. However, all the Intermediate System Neighbours options shall precede the End System Neighbours options. i.e. they shall appear before any End System Neighbours options in the same LSP and no End System Neighbours options shall appear in an LSP with lower LSP number.

    x CODE – 2.
    x LENGTH – 1 plus a multiple of (IDLength+5).
    x VALUE –

			No. of Octets
Virtual Flag			1
0	I/E	Default Metric	1
S	I/E	Delay Metric	1
S	I/E	Expense Metric	1
S	I/E	Error Metric	1
Neighbor ID			ID Length + 1
0	I/E	Default Metric	1
S	I/E	Delay Metric	1
S	I/E	Expense Metric	1
S	I/E	Error Metric	1
Neighbor ID			ID Length +1

· Virtual Flag is a Boolean. If equal to 1, this indicates the link is really a Level 2 path to repair an area partition. (Level 1 Intermediate Systems would always report this octet as 0 to all neighbours).

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· Default Metric is the value of the default metric for the link to the listed neighbour. Bit 8 of this field is reserved. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· Delay Metric is the value of the delay metric for the link to the listed neighbour. If this IS does not support this metric it shall set bit "S" to 1 to indicate that the metric is unsupported. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· Expense Metric is the value of the expense metric for the link to the listed neighbour. If this IS does not support this metric it shall set bit "S" to 1 to indicate that the metric is unsupported. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· Error Metric is the value of the error metric for the link to the listed neighbour. If this IS does not support this metric it shall set bit "S" to 1 to indicate that the metric is unsupported. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· Neighbour ID. For Intermediate System neighbours, neighbour ID field consists of the neighbour system's ID, followed by an octet containing the value zero. For pseudonode neighbours, the first ID Length octets is the LAN Level 1 Designated Intermediate System's ID, and the last octet is a non-zero quantity defined by the LAN Level 1 Designated Intermediate System.

- End System Neighbours – End system neighbours This may appear more than once, and in an LSP with any LSP number. See the description of the Intermediate System Neighbours option above for the relative ordering constraints. Only adjacencies with identical costs can appear in the same list.

  x CODE – 3.
  x LENGTH – 4, plus a multiple of IDLength.
  x VALUE –

			No. of Octets
	Virtual Flag		1
0	I/E	Default Metric	1
S	I/E	Delay Metric	1
S	I/E	Expense Metric	1
S	I/E	Error Metric	1
	Neighbor ID		ID Length
	Neighbor ID		ID Length

· Default Metric is the value of the default metric for the link to each of the listed neigh-bours. Bit 8 of this field is reserved. Bit 7 (marked I/E) indicates the metric type, and shall contain the value "0", indicating an internal metric.

· Delay Metric is the value of the delay metric for the link to each of the listed neighbours. If this IS does not support this metric it shall set the bit "S" to 1 to indicate that the metric is
unsupported. Bit 7 (marked I/E) indicates the metric type, and shall contain the value "0", indicating an internal metric.

· Expense Metric is the value of the expense metric for the link to each of the listed neighbours. If this IS does not support this metric it shall set the bit "S" to 1 to indicate that the metric is unsupported. Bit 7 (marked I/E) indicates the metric type, and shall contain the value "0", indicating an internal metric.

· Error Metric is the value of the error metric for the link to each of the listed neighbour. If this IS does not support this metric it shall set the bit "S" to 1 to indicate that the metric is unsupported. Bit 7 (marked I/E) indicates the metric type, and shall contain the value "0", indicating an internal metric.

· Neighbour ID – system ID of End system neighbour.

- Authentication Information — information for performing authentication of the originator of the PDU.

  x CODE — 10.
  x LENGTH — variable from 1–254 octets
  x VALUE —

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No. of Octets

Authentication Type	1
Authentication Value	VARIABLE

· Authentication Type — a one octet identifier for the type of authentication to be carried out. The following values are defined:

0 — RESERVED

1 — Cleartext Password

2–254 — RESERVED

255 — Routeing Domain private authentication method

· Authentication Value — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

9.9   Level 2 link state PDU

Level 2 Link State PDUs are generated by Level 2 Intermediate systems, and propagated throughout the level 2 domain. The contents of the Level 2 Link State PDU indicates the state of the adjacencies to neighbour Level 2 Intermediate Systems, or pseudonodes, and to reachable address prefixes of the Intermediate system that originally generated the PDU.

No. of Octets

Intradomain Routeing Protocol Discriminator	1
Length Indicator	1
Version/Protocol ID Extension	1
ID Length	1
R R R PDU Type	1
Version	1
Reserved	1
Maximum Area Addresses	1
PDU Length	2
Remaining Lifetime	2
LSP ID	ID Length + 2
Sequence Number	4
Checksum	2
P ATT LSPDBOL IS Type	1
VARIABLE LENGTH FIELDS	VARIABLE

- Intradomain Routeing Protocol Discriminator – architectural constant

- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  • An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  • The value zero, which indicates a 6 octet ID field length

  • The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

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- PDU Type (bits 1 through 5) – 20.

NOTE 62   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt.

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

  - An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  - The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

NOTE 63 This field is ignored on receipt.

- PDU Length – Entire Length of this PDU, in octets, including header.

- Remaining Lifetime – Number of seconds before LSP considered expired

- LSP ID – the system ID of the source of the Link State PDU. It is structured as follows:

	No. of Octets
Source ID	ID Length
Pseudonode ID	1
LSP Number	1

- Sequence Number – sequence number of LSP

- Checksum – Checksum of contents of LSP from Source ID to end. Checksum is computed as described in 7.3.11.

- P/ATT/LSPDBOL/IS Type

  - P – Bit 8, indicates when set that the issuing Intermediate System supports the Partition Repair optional function.

  - ATT - Bits 7-4 indicate, when set, that the issuing Intermediate System is 'attached' to other areas using:

  NOTE 64 These bits are ignored on receipt.

  x Bit 4 - the Default Metric
  x Bit 5 - the Delay Metric
  x Bit 6 - the Expense Metric
  x Bit 7 - the Error Metric.

  - LSPDBOL – Bit 3 – A value of 0 indicates no LSP Database Overload, and a value of 1 indicates that the LSP Database is Overloaded. An LSP with this bit set will not be used by any decision process to calculate routes to another IS through the originating system.

  - IS Type – Bits 1 and 2 indicate the type of Intermediate System – One of the following values:

  x 0 – Unused value
  x 1 – (i.e. bit 1 set) Level 1 Intermediate system
  x 2 – Unused value
  x 3 – (i.e. bits 1 and 2 set) Level 2 Intermediate system.

  NOTE 65 In a Level 2 Link State PDU, IS Type shall be 3.

- VARIABLE LENGTH FIELDS – fields of the form:

	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received LSP that are not recognised are ignored and passed through unchanged.

Currently defined codes are:

- Area Addresses – the set of partitionArea-Addresses of this Intermediate system, if the system supports partition repair, otherwise the set of areaAddresses of the IS. For non-pseudonode LSPs this option shall always be present in the LSP with LSP number zero, and shall never be present in an LSP with non-zero LSP number. It shall appear before any Intermediate System Neighbours or Prefix Neighbours options. This option shall never be present in pseudonode LSPs.

  x CODE – 1
  x LENGTH – total length of the value field.
  x VALUE –

	No. of Octets
Address Length	1
Area Address	Address Length
Address Length	1
Area Address	Address Length

· Address Length – Length of area address in octets.

· Area Address – Area address.

- Partition Designated Level 2 Intermediate System – ID of Designated Level 2 Intermediate System for the partition. For non-pseudonode LSPs issued by Intermediate Systems which support the partition repair optional function and which are currently ATTACHED, this option shall always be present in the LSP with LSP number zero, and shall never be present in an LSP with non-zero LSP number. It shall appear before any Intermediate System Neighbours or Prefix Neighbours options. This option shall never be present in pseudonode LSPs.
  x CODE – 4.

  x LENGTH – IDLength
  x VALUE – systemID of Partition Designated Level 2 Intermediate System for the partition.

- originatingLSPBufferSize – the local value for originatingL2LSPBufferSize

  This may appear only once in an LSP with any LSP number. It shall appear before any Intermediate System Neighbours or Prefix Neighbours options.

  NOTE 66   It is recommended that this option be used only in the LSP with LSP number zero. However, the presence or absence of this option in any LSP shall not be required.

  x CODE – 14
  x LENGTH – 2
  x VALUE – 512 – 1492

- Intermediate System Neighbours – Intermediate system and pseudonode neighbours.

This is permitted to appear more than once, and in an LSP with any LSP number. However, all the Intermediate System Neighbours options shall precede the Prefix Neighbours options. i.e. they shall appear before any Prefix Neighbour options in the same LSP and no Prefix Neighbour options shall appear in an LSP with lower LSP number.

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x CODE – 2.
x LENGTH – 1 plus a multiple of (IDLength+5).
x VALUE –

No. of Octets

	Virtual Flag		1
0	I/E	Default Metric	1
S	I/E	Delay Metric	1
S	I/E	Expense Metric	1
S	I/E	Error Metric	1
	Neighbor ID		ID Length + 1
0	I/E	Default Metric	1
S	I/E	Delay Metric	1
S	I/E	Expense Metric	1
S	I/E	Error Metric	1
	Neighbor ID		ID Length +1

· **Virtual Flag** is a Boolean. If equal to 1, this indicates the link is really a Level 2 path to repair an area partition. (Level 1 Intermediate Systems would always report this octet as 0 to all neighbours).

· **Default Metric** is the value of the default metric for the link to the listed neighbour. Bit 8 of this field is reserved. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· **Delay Metric** is the value of the delay metric for the link to the listed neighbour. If this IS does not support this metric it shall set bit "S" to 1 to indicate that the metric is unsupported. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· **Expense Metric** is the value of the expense metric for the link to the listed neighbour. If this IS does not support this metric it shall set bit "S" to 1 to indicate that the metric is unsupported. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· **Error Metric** is the value of the error metric for the link to the listed neighbour. If this IS does not support this metric it shall set bit "S" to 1 to indicate that the metric is unsupported. Bit 7 of this field (marked I/E) indicates the metric type, and shall contain the value "0", indicating an Internal metric.

· **Neighbour ID** – For Intermediate System neighbours, the first **ID Length** octets are the neighbour's system ID, and the last octet is 0. For pseudonode neighbours, the first **ID Length** octets is the LAN Level 2 Designated Intermediate System's ID, and the last octet is a non-zero quantity defined by the LAN Level 2 Designated Intermediate System.

•   **Prefix Neighbours** – reachable address prefix neighbours

This may appear more than once, and in an LSP with any LSP number. See the description of the **Intermediate System Neighbours** option above for the relative ordering constraints. Only adjacencies with identical costs can appear in the same list.

x CODE – 5.
x LENGTH – Total length of the VALUE field.
x VALUE –

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No. of Octets

0	I/E	Default Metric	1
S	I/E	Delay Metric	1
S	I/E	Expense Metric	1
S	I/E	Error Metric	1
Address Prefix Length	1
Address Prefix	⌈Address Prefix Length / 2⌉
Address Prefix Length	1
Address Prefix	⌈Address Prefix Length / 2⌉

· **Default Metric** is the value of the default metric for the link to each of the listed neigh-bours. Bit 8 of this field is reserved. Bit 7 (marked I/E) indicates the metric type, and may be set to zero indicating an internal metric, or may be set to 1 indicating an external metric.

· **Delay Metric** is the value of the delay metric for the link to each of the listed neighbours. If this IS does not support this metric it shall set the bit "S" to 1 to indicate that the metric is unsupported. Bit 7 (marked I/E) indicates the metric type, and may be set to zero indicating an internal metric, or may be set to 1 indicating an external metric.

· **Expense Metric** is the value of the expense metric for the link to each of the listed neighbours. If this IS does not support this metric it shall set the bit "S" to 1 to indicate that the metric is unsupported. Bit 7 (marked I/E) indicates the metric type, and may be set to zero indicating an internal metric, or may be set to 1 indicating an external metric.

· **Error Metric** is the value of the error metric for the link to each of the listed neighbour. If this IS does not support this metric it shall set the bit "S" to 1 to indicate that the metric is unsupported. Bit 7 (marked I/E) indicates the metric type, and may be set to zero indicating an internal metric, or may be set to 1 indicating an external metric.

· **Address Prefix Length** is the length in **semi-octets** of the following prefix. A length of zero indicates a prefix that matches all NSAPs.

· **Address Prefix** is a reachable address prefix encoded as described in 7.1.6. If the length in semi-octets is odd, the prefix is padded out to an integral number of octets with a trailing
zero semi-octet.

Note that the area addresses listed in the **Area Addresses** option field of Level 2 Link State PDU with LSP number zero, are understood to be reachable address neighbours with cost zero. They are not listed separately in the **Prefix Neighbours** options.

• Authentication Information — information for performing authentication of the originator of the PDU.

x CODE — 10.
x LENGTH — variable from 1–254 octets
x VALUE —

No. of Octets

Authentication Type	1
Authentication Value	VARIABLE

· **Authentication Type** — a one octet identifier for the type of authentication to be carried out. The following values are defined:

0 — RESERVED
1 — Cleartext Password
2–254 — RESERVED
255 — Routeing Domain private authentication method

· **Authentication Value** — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

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9.10 Level 1 complete sequence numbers PDU

No. of Octets

Intradomain Routeing Protocol Discriminator				1
Length Indicator				1
Version/Protocol ID Extension				1
ID Length				1
R	R	R	PDU Type	1
Version				1
Reserved				1
Maximum Area Addresses				1
PDU Length				2
Source ID				ID Length + 1
Start LSP ID				ID Length + 2
End LSP ID				ID Length + 2
VARIABLE LENGTH FIELDS				VARIABLE

- Intradomain Routeing Protocol Discriminator – architectural constant (see table 2)

- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

    • An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

    • The value zero, which indicates a 6 octet ID field length

    • The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type (bits 1 through 5) – 24.

NOTE 67   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt.

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

    • An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

    • The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

- PDU Length – Entire Length of this PDU, in octets, including header

- Source ID – the system ID of Intermediate System (with zero Circuit ID) generating this Sequence Numbers PDU.

- Start LSP ID – the LSP ID of first LSP in the range covered by this Complete Sequence Numbers PDU.

- End LSP ID – the LSP ID of last LSP in the range covered by this Complete Sequence Numbers PDU.

- VARIABLE LENGTH FIELDS – fields of the form:

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	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received CSNP that are not recognised are ignored.

Currently defined codes are:

- LSP Entries – This may appear more than once. The option fields, if they appear more than once, shall appear sorted into ascending LSPID order.

  x CODE – 9
  x LENGTH – total length of the value field.
  x VALUE – a list of LSP entries of the form:

	No. of Octets
Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2
Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2

· Remaining Lifetime – Remaining Lifetime of LSP.

· LSP ID – system ID of the LSP to which this entry refers.

· LSP Sequence Number – Sequence number of LSP.

· Checksum – Checksum reported in LSP.

The entries shall be sorted into ascending LSPID order (the LSP number octet of the LSPID is the least significant octet).

- Authentication Information — information for performing authentication of the originator of the PDU.

  x CODE — 10.
  x LENGTH — variable from 1–254 octets
  x VALUE —

	No. of Octets
Authentication Type	1
Authentication Value	VARIABLE

· Authentication Type — a one octet identifier for the type of authentication to be carried out. The following values are defined:

  0 — RESERVED
  1 — Cleartext Password
  2–254 — RESERVED
  255 — Routeing Domain private authentication method

· Authentication Value — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

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9.11 Level 2 complete sequence numbers PDU

	No. of Octets
Intradomain Routeing Protocol Discriminator	1
Length Indicator	1
Version/Protocol ID Extension	1
ID Length	1
R | R | R | PDU Type	1
Version	1
Reserved	1
Maximum Area Addresses	1
PDU Length	2
Source ID	ID Length + 1
Start LSP ID	ID Length + 2
End LSP ID	ID Length + 2
VARIABLE LENGTH FIELDS	VARIABLE

- Intradomain Routeing Protocol Discriminator – architectural constant (see table 2)

- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  - An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  - The value zero, which indicates a 6 octet ID field length

  - The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type (bits 1 through 5) – 25.

NOTE 68   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

  - An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  - The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

  NOTE 69   This field is ignored on receipt.

- PDU Length – Entire Length of this PDU, in octets, including header

- Source ID – the system ID of Intermediate System (with zero Circuit ID) generating this Sequence Numbers PDU.

- Start LSP ID – the LSP ID of first LSP in the range covered by this Complete Sequence Numbers PDU.

- End LSP ID – the LSP ID of last LSP in the range covered by this Complete Sequence Numbers PDU.

- VARIABLE LENGTH FIELDS – fields of the form:

No. of Octets

CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received CSNP that are not recognised are ignored.

Currently defined codes are:

- LSP Entries – this may appear more than once. The option fields, if they appear more than once, shall appear sorted into ascending LSPID order.

   x CODE – 9
   x LENGTH – total length of the value field.
   x VALUE – a list of LSP entries of the form:

No. of Octets

Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2
Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2

· Remaining Lifetime – Remaining Lifetime of LSP.

· LSP ID – the system ID of the LSP to which this entry refers.

· LSP Sequence Number – Sequence number of LSP.

· Checksum – Checksum reported in LSP.

The entries shall be sorted into ascending LSPID order (the LSP number octet of the LSPID is the least significant octet).

- Authentication Information — information for performing authentication of the originator of the PDU.

   x CODE — 10.
   x LENGTH — variable from 1–254 octets
   x VALUE —

No. of Octets

Authentication Type	1
Authentication Value	VARIABLE

· Authentication Type — a one octet identifier for the type of authentication to be carried out. The following values are defined:

   0 — RESERVED
   1 — Cleartext Password
   2–254 — RESERVED
   255 — Routeing Domain private authentication method

· Authentication Value — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

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9.12 Level 1 partial sequence numbers PDU

No. of Octets

Intradomain Routeing Protocol Discriminator				1
Length Indicator				1
Version/Protocol ID Extension				1
ID Length				1
R	R	R	PDU Type	1
Version				1
Reserved				1
Maximum Area Addresses				1
PDU Length				2
Source ID				ID Length + 1
VARIABLE LENGTH FIELDS				VARIABLE

- Intradomain Routeing Protocol Discriminator – architectural constant (see table 2)
- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  - An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  - The value zero, which indicates a 6 octet ID field length

  - The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type (bits 1 through 5) – 26.

NOTE 70   Bits 6, 7 and 8 are Reserved, which means they are transmitted as 0 and ignored on receipt.

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

  - An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  - The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

- PDU Length – Entire Length of this PDU, in octets, including header

- Source ID – the system ID of Intermediate system (with zero Circuit ID) generating this Sequence Numbers PDU.

- VARIABLE LENGTH FIELDS – fields of the form:

No. of Octets

CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received PSNP that are not recognised are ignored.

Currently defined codes are:

- **LSP Entries** – this may appear more than once. The option fields, if they appear more than once, shall appear sorted into ascending LSPID order.

  x CODE – 9
  x LENGTH – total length of the value field.
  x VALUE – a list of LSP entries of the form:

	No. of Octets
Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2
Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2

· **Remaining Lifetime** – Remaining Lifetime of LSP.

· **LSP ID** – the system ID of the LSP to which this entry refers.

· **LSP Sequence Number** – Sequence number of LSP.

· **Checksum** – Checksum reported in LSP.

The entries shall be sorted into ascending LSPID order (the LSP number octet of the LSPID is the least significant octet).

- **Authentication Information** — information for performing authentication of the originator of the PDU.

  x CODE — 10.
  x LENGTH — variable from 1–254 octets
  x VALUE —

	No. of Octets
Authentication Type	1
Authentication Value	VARIABLE

· **Authentication Type** — a one octet identifier for the type of authentication to be carried out. The following values are defined:

  0 — RESERVED
  1 — Cleartext Password
  2–254 — RESERVED
  255 — Routeing Domain private authentication method

· **Authentication Value** — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

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9.13 Level 2 partial sequence numbers PDU

	No. of Octets
Intradomain Routeing Protocol Discriminator	1
Length Indicator	1
Version/Protocol ID Extension	1
ID Length	1
R R R PDU Type	1
Version	1
Reserved	1
Maximum Area Addresses	1
PDU Length	2
Source ID	ID Length + 1
VARIABLE LENGTH FIELDS	VARIABLE

- Intradomain Routeing Protocol Discriminator – architectural constant (see table 2)

- Length Indicator – Length of fixed header in octets

- Version/Protocol ID Extension – 1

- ID Length — Length of the ID field of NSAP addresses and NETs used in this routeing domain. This field shall take on one of the following values:

  • An integer between 1 and 8, inclusive, indicating an ID field of the corresponding length

  • The value zero, which indicates a 6 octet ID field length

  • The value 255, which means a null ID field (i.e. zero length)

All other values are illegal and shall not be used.

- PDU Type (bits 1 through 5) – 27.

- Version – 1

- Reserved — transmitted as zero, ignored on receipt

- Maximum Area Addresses — number of area addresses permitted for this ISs area, as derived from the value of the System Management parameter maximumArea-Addresses. This field shall take on of the following values:

  • An integer between 1 and 254 inclusive, indicated a corresponding number of area addresses supported.

  • The value zero, which is treated upon reception as if it were equal to three, and which the IS may use if it supports only a value of 3 for maximumAreaAddresses.

  NOTE 71   This field is ignored on receipt.

- PDU Length – Entire Length of this PDU, in octets, including header

- Source ID – the system ID of Intermediate system (with zero Circuit ID) generating this Sequence Numbers PDU.

- VARIABLE LENGTH FIELDS – fields of the form:

	No. of Octets
CODE	1
LENGTH	1
VALUE	LENGTH

Any codes in a received PSNP that are not recognised are ignored.

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Currently defined codes are:

- LSP Entries – this may appear more than once. The option fields, if they appear more than once, shall appear sorted into ascending LSPID order.

  x CODE – 9
  x LENGTH – total length of the value field.
  x VALUE – a list of LSP entries of the form:

  No. of Octets

Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2
Remaining Lifetime	2
LSP ID	ID Length + 2
LSP Sequence Number	4
Checksum	2

· **Remaining Lifetime** – Remaining Lifetime of LSP.

· **LSP ID** – the system ID of the LSP to which this entry refers.

· **LSP Sequence Number** – Sequence number of LSP.

· **Checksum** – Checksum reported in LSP. The entries shall be sorted into ascending LSPID order (the LSP number octet of the LSPID is the least significant octet).

- Authentication Information — information for performing authentication of the originator of the PDU.

  x CODE — 10.
  x LENGTH — variable from 1–254 octets
  x VALUE —

  No. of Octets

Authentication Type	1
Authentication Value	VARIABLE

  · **Authentication Type** — a one octet identifier for the type of authentication to be carried out. The following values are defined:

    0 — RESERVED
    1 — Cleartext Password
    2–254 — RESERVED
    255 — Routeing Domain private authentication method

  · **Authentication Value** — determined by the value of the authentication type. If Cleartext Password as defined in this International Standard is used, then the authentication value is an octet string.

10   System environment

10.1   Generating jitter on timers

When PDUs are transmitted as a result of timer expiration, there is a danger that the timers of individual systems may become synchronised. The result of this is that the traffic distribution will contain peaks. Where there are a large number of synchronised systems, this can cause overloading of both the transmission medium and the systems receiving the PDUs. In order to prevent this from occurring, all periodic timers, the expiration of which can cause the transmission of PDUs, shall have "jitter" introduced as defined in the following algorithm.